



MURRAY
RADIATORS



MURRAY RADIATORS



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MURRAY RADIATOR CORPORATION
37 West 39th Street, New York

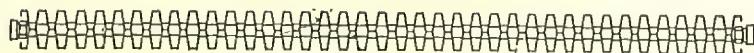
Division

AMERICAN RADIATOR
&
STANDARD SANITARY
C O R P O R A T I O N

F A C T O R I E S

1250 Atlantic Avenue, Brooklyn, N. Y.

510 King Street, East, Toronto, Canada

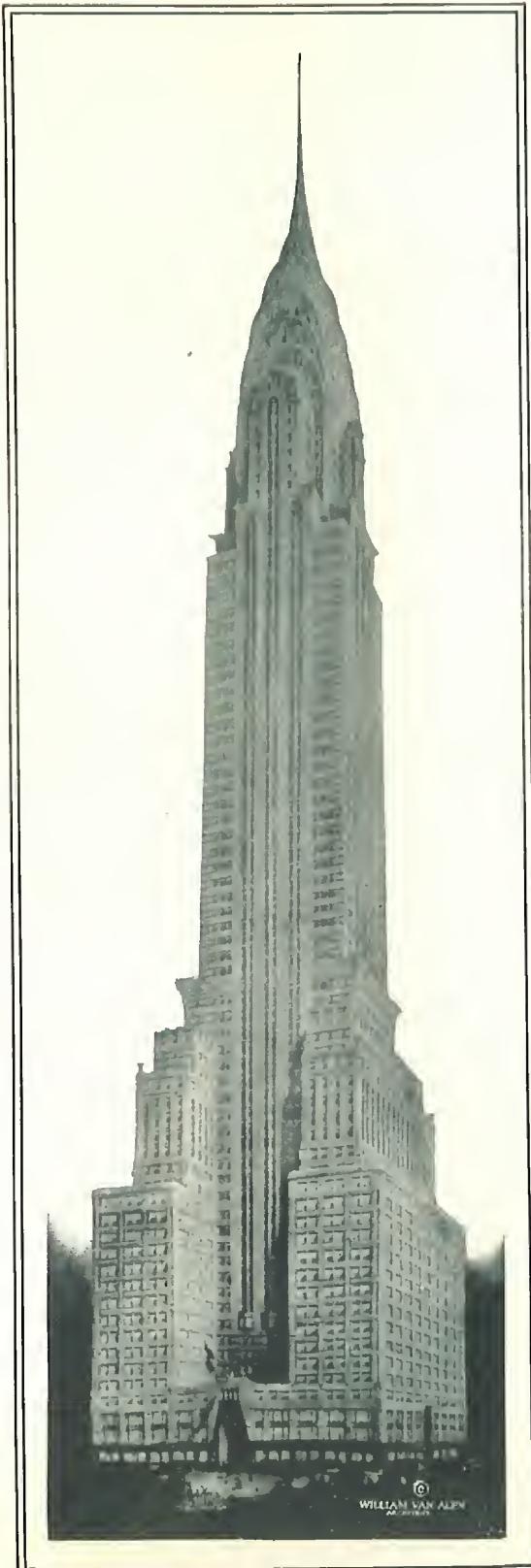


CHRYSLER
BUILDING
NEW YORK
(See Page 37)

"WORLD'S
TALLEST"

WILLIAM VAN ALEN
Architect

LOUIS T. M. RALSTON
Engineer



"RADIATORS
By
MURRAY."

FRED T. LEY & CO., INC.
General Contractors

BAKER SMITH & CO.
Heating Contractors



FOREWORD

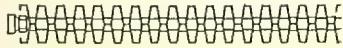


THE MURRAY RADIATOR is more than a decided advance in radiators, for it utilizes the basic principles of conduction and convection to a degree never before attained.

It represents a new form of heating and is the pioneer in its field.

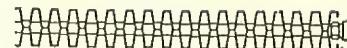
MURRAY RADIATORS are used in the largest buildings in America, notably: The Fisher Bldg., The Chrysler Bldg., The George A. Fuller Bldg., Hotel New Yorker, The Board of Education New York, Consolidated Gas Co. Bldg., Medical Arts and National City Bank Building.

This heating device is the result of the inventive genius of Thomas E. Murray, whose patents and engineering developments in many fields are recognized not only in America, but in all parts of the world.



MURRAY PATENTS

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FISHER BUILDING . . DETROIT, MICH.

ALBERT KAHN, INC.
Architects & Engineers

JOHNSON, LARSEN & Co.
Heating Contractors

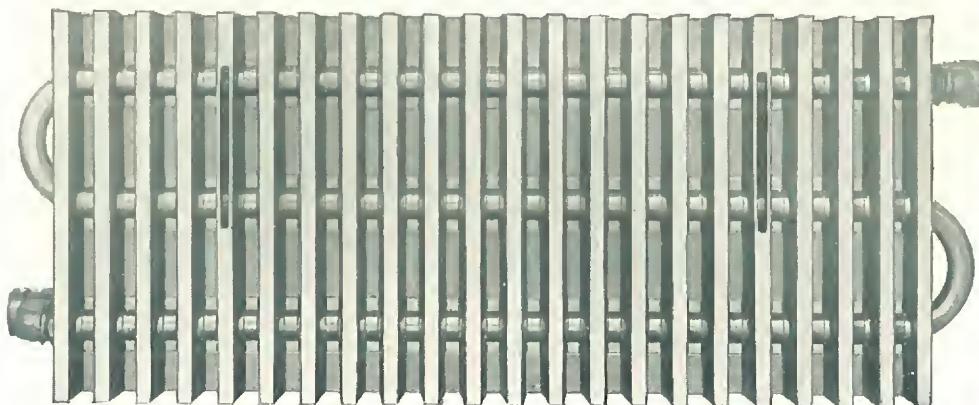
MURRAY RADIATORS Installed throughout this Building
(See page 15 for installation detail)



MURRAY RADIATORS

THE MURRAY RADIATOR is a heating unit of the complete convection type. It is made of a metal having high thermal conductivity and the most practical to use for the greatest amount of heat transmission.

The heating units consist of a steam chamber in the form of a *seamless copper tube*. There are no brazed, or soldered joints in the steam chamber. The *seamless copper tube* insures quick circulation and makes air pockets impossible.

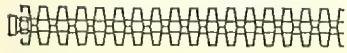


Above Cut Illustrates How Seamless Copper Tubing is Employed

Connections to the main steam lines are obtained by the use of a union type joint which has been standard practice for years, in various industries. Insurance against leaks, corrosion and other troubles is accomplished by the use of this joint in conjunction with the *seamless copper tube*.

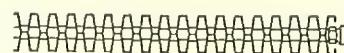
The extended surfaces or "chimneys" are made of high conductivity metal and formed in special dies. These "chimneys" or flues made in continuous one piece sections, are welded about the steam chamber.

In order to understand this welded contact between extended surface and prime surface insuring perfect heat transmission, and to distinguish it from brazed or soldered joints, it should be kept in mind that it is accomplished by use of the well known "Murray Patented Welding Process."

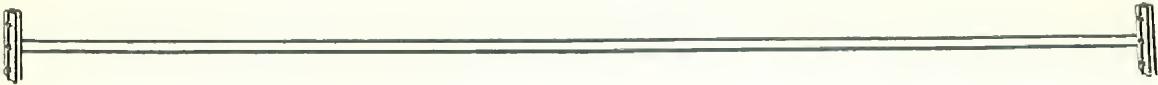


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This process, carried out by using hundreds of thousands of amperes per square inch of welded area with corresponding tons of welding pressure for fractions of seconds, insures absolute uniformity of product, indefinite life and distinguishes the MURRAY RADIATOR from all others in this most vital part of "extended area" type of construction.

Illustrations on this page show a radiator segment of two sections and the "Murray Patented Weld."

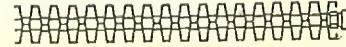
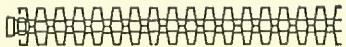
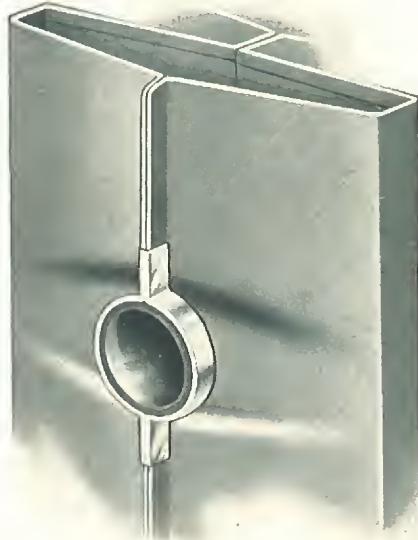
The design permits, without obstruction, the rapid passage of air through the "chimneys" or flues formed by the extended surfaces.

The air entering the base of each flue is rapidly heated by the hot extended and prime surfaces and is discharged at the top. A uniform temperature is effected in all parts of the room through the self induced rapid circulation,—convection heating.

When one enters a room heated by MURRAY RADIATORS a most pleasing and comfortable reaction is immediately apparent. This is due to the absence of "Burning Radiant Heat" as well as to the evenness of temperature resulting from the convection heating.

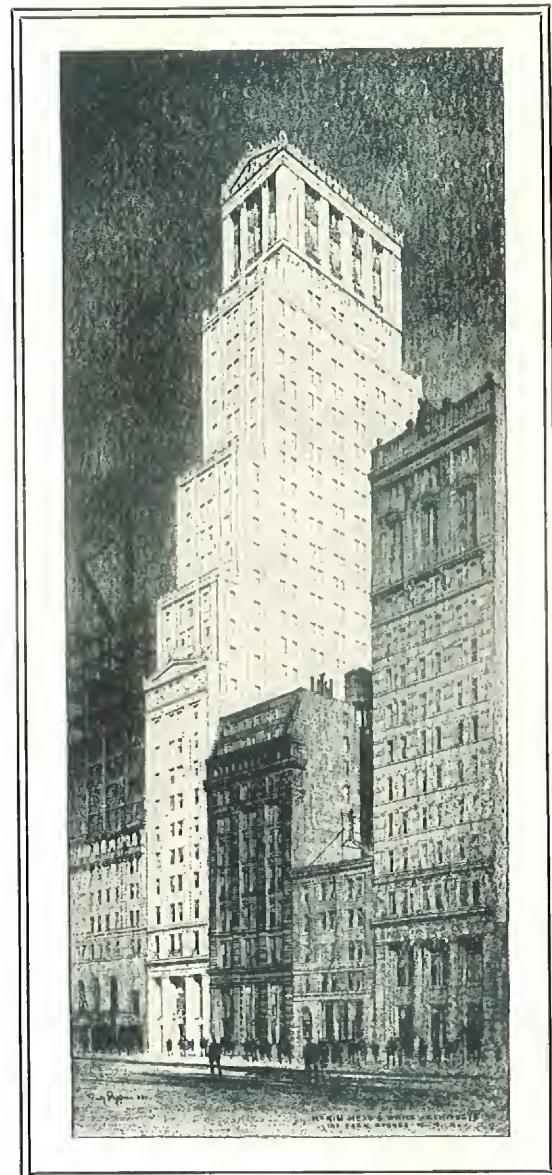
The design of the MURRAY RADIATOR is such that it can be used on any pressure available for heating purposes, and in fact is now being used at over 200 pounds pressure.

All MURRAY RADIATORS are subjected to a test of 200 pounds before shipping.



GRANT BUILDING
Pittsburg, Pa.

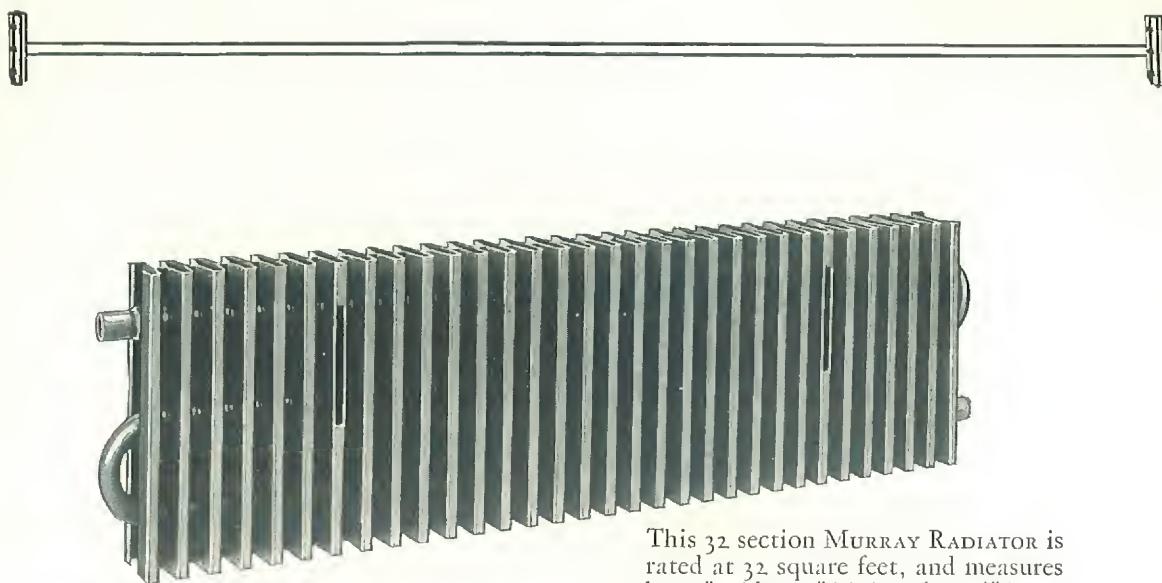
HENRY HORNBOSTEL, *Architect*
THOMAS PAYNE, *Consulting Engineer*
THOMPSON STARRETT CO.
General Contractors
McGINNESS, SMITH & McGINNESS
Heating Contractors



NATIONAL CITY COMPANY BUILDING
New York City

McKIM, MEADE & WHITE, *Architects*
TENNEY & OHMES, *Engineers*
BAKER SMITH & CO., *Heating Contractors*

MURRAY RADIATORS Installed Throughout These Buildings

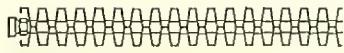
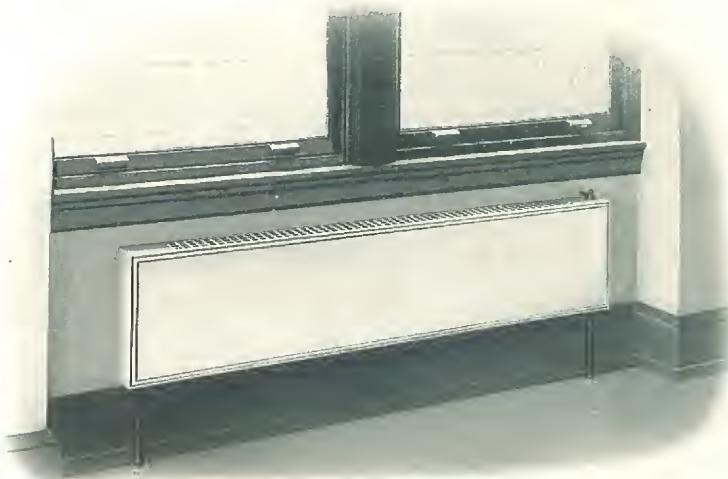


This 32 section MURRAY RADIATOR is rated at 32 square feet, and measures but 3" wide, 14" high and $50\frac{1}{2}$ " long.

The MURRAY RADIATOR is so designed that it can be used with or without a cover. When used as exposed radiation we recommend the use of the cover. When recessed no cover is required, although inlet and outlet openings must be provided, their treatment being dependent on the architecture employed.

There are three types of MURRAY RADIATOR Covers. Type A—Encloses radiator only and has top discharge grille. Type B—Encloses valve and trap and also has top discharge grille. Type C—Encloses radiator only but has front discharge grille. Detailed information, on the uses of each type of cover, is given in heating specifications.

The type "B" cover assures an extremely good looking installation.

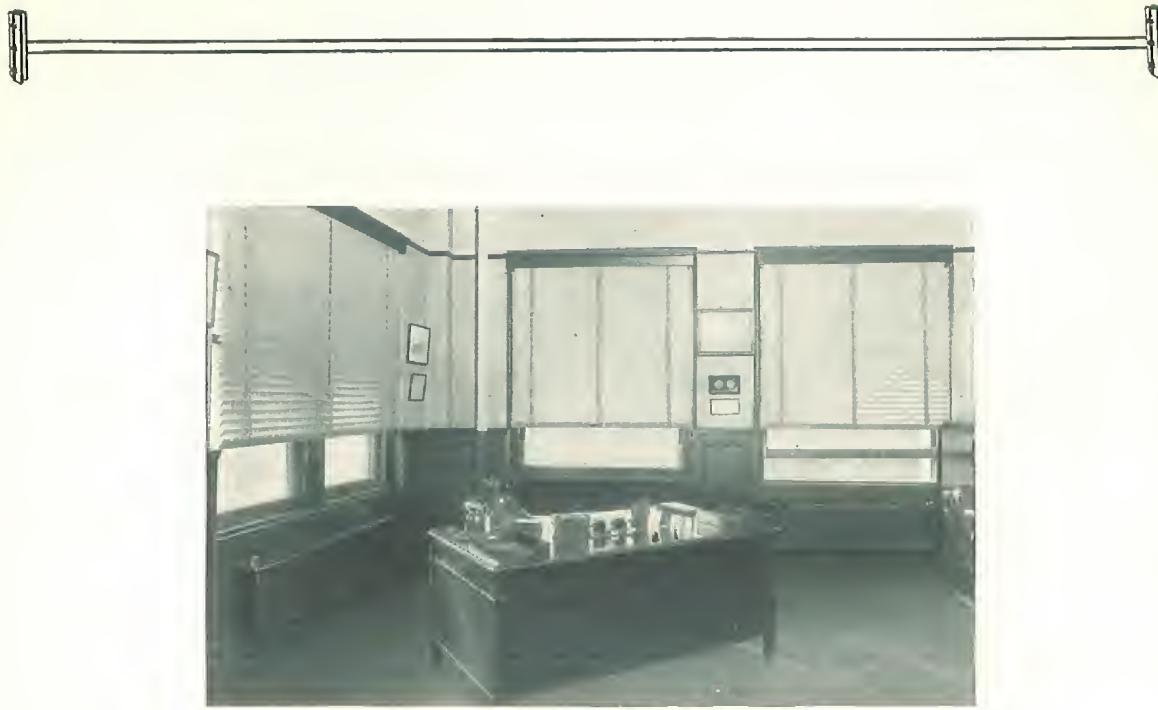


MURRAY RADIATOR CORPORATION

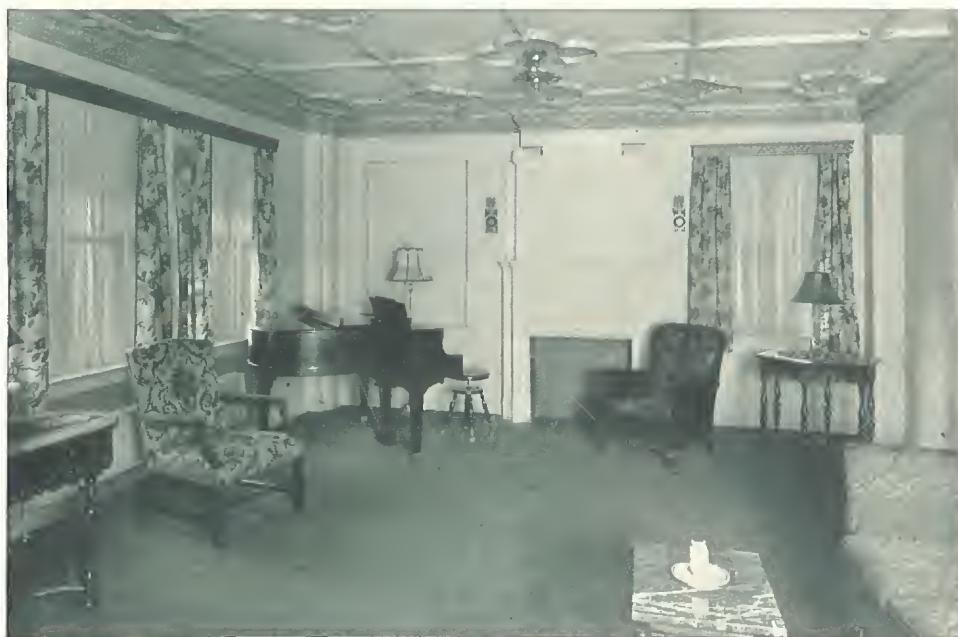
PAGE EIGHT



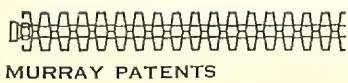
MURRAY PATENTS



The attractiveness and comparative invisibility of MURRAY RADIATORS will be noted in this mahogany panelled office.

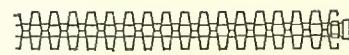


The exposed MURRAY RADIATOR in above installation is equipped with type "A" Cover. Arrangement of room is not dominated by MURRAY RADIATORS and objects may be located where good taste dictates.



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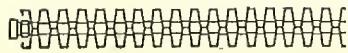
PAGE NINE



That MURRAY RADIATORS detract nothing from the appearance of the most elaborate furnishings is clearly shown in these photographs. Note that radiators are installed directly under windows.

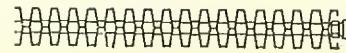


No other radiators are as simply or effectively recessed as MURRAY RADIATORS. It is unnecessary to build false flues in the wall structure, for the radiator construction itself is sufficient.



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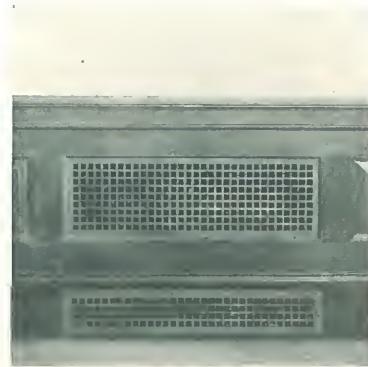
The MURRAY RADIATOR is so designed that it may be incorporated in the wall structure, the variety of sizes and shapes permitting practically any space conditions to be met. In such cases it is necessary to provide inlet and outlet openings which may be suitably griled or otherwise treated.

No "false chimneys" are necessary to increase circulation in heating unit, as this feature is directly incorporated in the MURRAY RADIATOR design. Little or no insulation is required as the absence of radiant energy reduces heat loss through walls to a minimum.

For detailed information on several standard types of enclosures for office building and apartment installation see pages nineteen to forty.



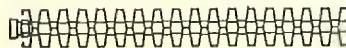
MURRAY RADIATOR 6 $\frac{5}{8}$ inches in width and 9 $\frac{1}{2}$ inches in height installed below window measuring 19 feet in width and 16 feet in height. This type will be found especially suited for show rooms.



The 1622 sizes of MURRAY RADIATORS make it possible to meet any installation need.

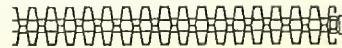


Various Methods of Recessing MURRAY RADIATORS



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Characteristics of MURRAY RADIATORS

Space Economy

A MURRAY RADIATOR requires only approximately one-third the actual space of a cast iron radiator. In addition, there is a still further space saving because all the area immediately adjacent to the MURRAY RADIATOR can be utilized. This is possible, because of the absence of burning radiation, so unpleasant and uncomfortable.

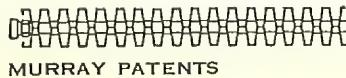
In an office this means that equipment may be placed without regard to radiator location, and in residences objects located to conform with any decorative motif.

Weight

The weight of the MURRAY RADIATOR is approximately one-seventh that of cast iron. This reduced weight means material savings in shipping, handling and setting, and in the structural design of buildings.

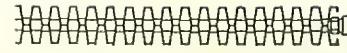
In fact, the weight permits of packing and shipping the ordinary sized radiator in corrugated cartons. Handling to and on the job is thus greatly expedited.

An ordinary crew can set three to four times as many MURRAY RADIATORS as cast iron.



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Speed of Heating

The response of the MURRAY RADIATOR is extremely rapid, the heating time being a matter of seconds. The high air temperature and velocities cause the entire room to be brought quickly and evenly to temperature.

One of the reasons for the remarkable results obtained with these radiators is found in the fact that the steam volume is only a fraction that of cast iron.

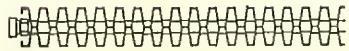
Fuel Economy

A substantial fuel saving may be realized by the proper choice of the radiator used for heating. The cast iron radiator heats the room in two ways,—first by convection to air surrounding the radiator,—second, by radiation transferring heat to walls and furniture, thence indirectly heating the air. A simple statement of the facts is, that convection heats the air of the room hotter than the walls, while radiation heats the walls hotter than the air. As heat loss depends upon the temperature of the walls the cool wall room will lose heat slower than the warm wall room.

Tests show that the cast iron radiator heats about 60% by convection and 40% by radiation, while the MURRAY RADIATOR heats about 95% by convection.

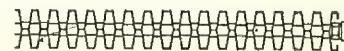
Heat loss must be a minimum when the radiator gives out its heat by convection, heating the air first and the walls second. Moreover the steam demand when raising the MURRAY RADIATOR to steam temperature is much less than in cast iron as the masses of material are in the ratio of one to seven.

The direct heat loss through the walls, in relation to cast iron radiators is reduced at least 30%, due to the fact that the projected area of the MURRAY RADIATOR against the wall is in this same proportion.



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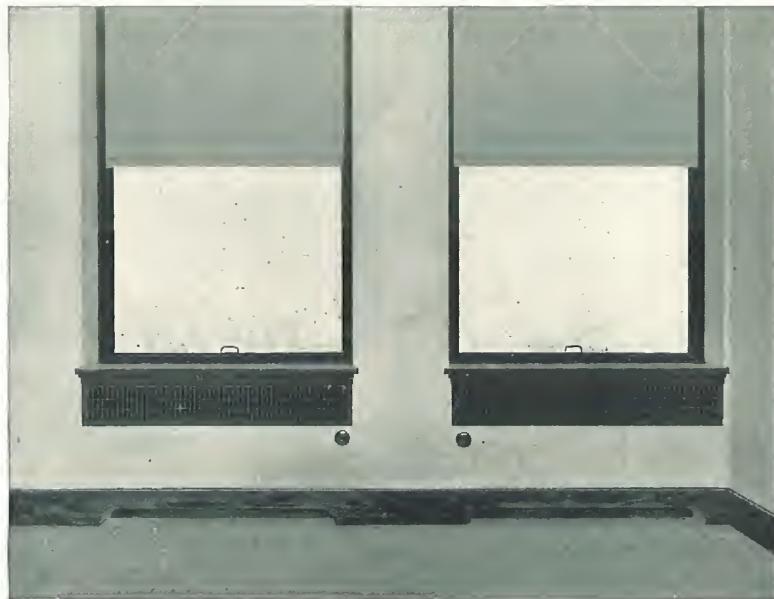


Apearance

The panel design of the MURRAY RADIATOR Cover is simple and dignified and fits in excellently with any decorative scheme. For rooms finished with wood paneling, the reproductions of mahogany, walnut or other woods suit admirably.

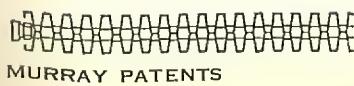
Exposed Murray Radiators do not dominate the arrangement, and furnishings may be placed just where good taste dictates.

There are several types of enclosures to select from when recessing Murray Radiators—each type built to harmonize with the surrounding architecture.



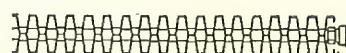
A particularly attractive recessed installation is shown in above photograph. Nothing is lost in efficiency when a MURRAY RADIATOR is recessed.

This catalog shows various installation methods and gives data of standard sized radiators. The adaptability of the design permits of many variations and we shall be glad to cooperate on any special problems.



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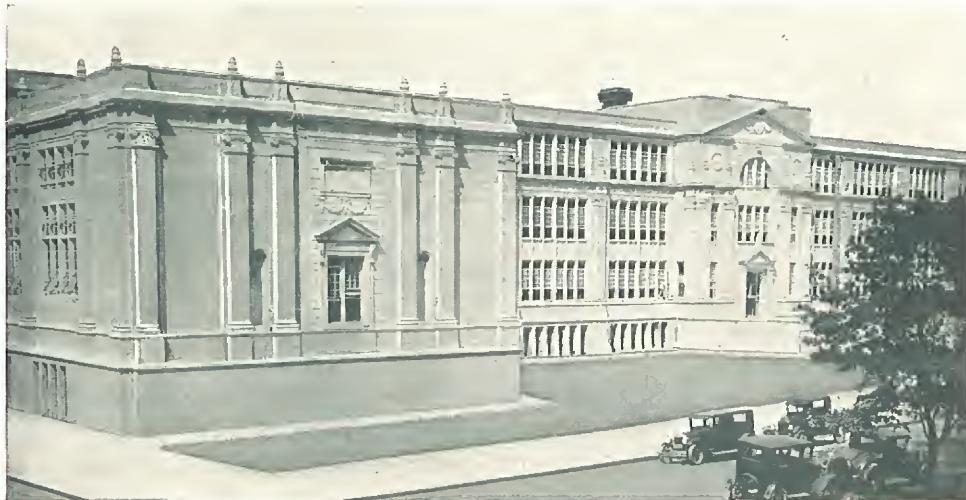
PAGE FIFTEEN



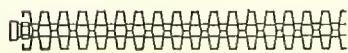
CONSOLIDATED GAS COMPANY
NEW YORK
BAKER SMITH & Co., *Heating Contractors*



800 FERRY ST. APARTMENT
BUFFALO, N. Y.
BLEY & LYMAN, *Architects*
J. DANFORTH, *Heating Contractors*
D. R. MARTIN CONSTRUCTION CO.
General Contractors

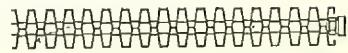


FAR ROCKAWAY HIGH SCHOOL, FAR ROCKAWAY, N. Y.
Wm. H. GOMPERT, *Architect*
HEAT CONTROL SERVICE, *Heating Contractors*



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BRICKEN APARTMENT, NEW YORK

SCHWARTZ & GROSS, Architects
JARCHO BROS., Heating Contractors
BRICKEN CONSTRUCTION CO., Owners and Builders



HOTEL NEW YORKER, NEW YORK

SUGARMAN & BERGER, Architects & Engineers
MACK KANNER, Builder
RAISLER HEATING CO., Heating Contractors



BERESFORD APARTMENT, NEW YORK

EMERY ROTH, Architect
EADIE, FREUND & CAMPBELL, Cons. Engrs.
H. R. H. CONSTRUCTION CO., Owners and Builders
RAISLER HEATING CO., Heating Contractors



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GEO. A.
FULLER
BUILDING
NEW
YORK



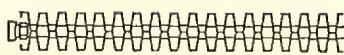
WALKER &
GILLETTE,
Architects

BAKER,
SMITH & CO.
*Heating
Contractors*

TENNEY &
ORMES,
Engineers

Recessed MURRAY RADIATORS Installed Throughout this Building

(See Pages 34 and 35)



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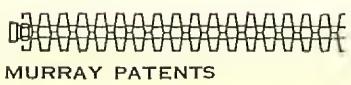
MURRAY RADIATOR CORPORATION



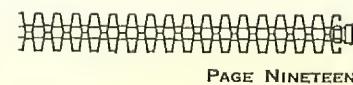
MURRAY PATENTS



SPECIFICATIONS AND ENGINEERING DATA



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ENGINEERING FOREWORD

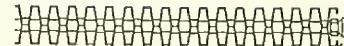
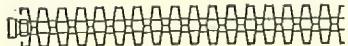
In the following pages are listed 1622 sizes of standard MURRAY RADIATORS, including 5 widths, 12 heights and 27 lengths; also two bathroom sizes. We believe this number is sufficient to meet most conditions. However, we are prepared to make odd numbered sections and special curved and offset radiators to order.

MURRAY RADIATORS are also used on cooling systems; combination heating and cooling systems and cooling cabinets. They are also being used as condensing units in refrigerators.

Several installations are now in operation using steam pressures varying from 100 to 210 pounds on MURRAY RADIATORS—the same radiators that are used in low pressure jobs. Steam pressures as high as 300 pounds can be safely used.

Professor E. H. Lockwood of the Mason Laboratory, Sheffield Scientific School, Yale University, and Professor Charles M. McKergow of McGill University, Montreal, P. Q., have checked the ratings herein given.

All tests were made with exposed radiators with one pound steam pressure and 70° room temperature.





HOW TO SPECIFY MURRAY RADIATORS

Radiators

Murray Radiators as manufactured by the Murray Radiator Corporation, shall be used.

Exposed Radiators

See Pages
40 and 42

Where Murray Radiators are exposed under windows, they shall be hung as close to sill as possible, allowing $\frac{3}{4}$ " under the sill for adjusting covers. They shall be hung approximately $\frac{1}{2}$ " from finished wall, allowing clearance for the valve handle and at least 3" from finished floor.

Covers for Exposed Radiators

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All exposed Murray Radiators under windows shall be supplied with Murray Steel Covers (Type "A" cover, enclosing radiator only—or Type "B" cover, enclosing valve and trap), having a top discharge grille with approximately 75% free area. Where Murray Radiators are hung on blank walls, the Murray Type "C" cover having a front discharge shall be used.

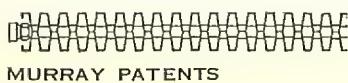
Paint

All Murray Radiators shall be supplied with a priming coat of black paint and all Murray Covers with a priming coat of neutral color to be finished by others as directed by the architect.

Hangers

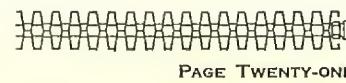
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Murray standard steel hangers shall be used. These shall be installed on the finished wall (or under furring).



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PAGE TWENTY-ONE

Enclosures

Murray steel enclosures shall be supplied for all Murray Radiators recessed under windows.

Enclosure Under Metal Windows

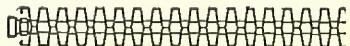
1. Murray steel enclosures shall consist of a 12 gage sill, 16 gage end channels, 16 gage removable front and 22 gage back. The sill shall be drilled to fasten to angle on metal windows supplied by the window manufacturer. The end channel shall extend approximately 2" below finished floor. This enclosure shall be installed before furring, plaster or finished floors are installed. The front shall be constructed to allow it to be removed readily. The enclosure shall allow 3" opening above the finished floor for cold air inlet. The discharge grille will be at least the width and length of the radiator with a free area of approximately 75% or 4 sq. in. per sq. ft. of radiation and shall be constructed (in the sill or in the removable front) as indicated on the plans. The radiator will be supported by angles built in the enclosure. The valves shall have extension stems and shall be installed on the sill.

See Pages
34, 35
& 36

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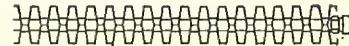
2. Murray steel enclosures shall consist of a 16 gage sheet with return ends. The enclosure shall extend the width and length of the sill and shall extend from the sill to the baseboard. Adjustable mouldings shall be attached to the return ends capable of taking up $\frac{1}{4}$ " irregularities in the plaster line. Extension sill with outlet grille by others.

3. Enclosures shall consist of a 16 gage sheet with return ends. The enclosure shall extend from the sill to the floor. Adjustable mouldings shall be attached to the return ends capable of taking up $\frac{1}{4}$ " irregularities in the plaster line. An inlet grille shall be constructed at the bottom extending approximately the length of the enclosure and shall be at least 3" high. Extension sill with outlet grille by others.



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PAGE TWENTY-TWO



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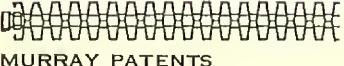
Enclosure Under Wood Window

See Page
38

1. Murray steel enclosures shall consist of a 16 gage removable front, 16 gage end channels and 22 gage back. The end channels shall be screwed to wood grounds by others. The removable front shall extend from the sill to the baseboard. The baseboard (by others) shall be constructed with a 3" slot at the floor and extend the length of the radiators,—or a grille 3" high and the length of the radiator having approximately 75% free area or 3 sq. in. per sq. ft. of radiation shall be installed in the baseboard by others. The discharge grille shall be constructed in the removable front and shall be at least the width and length of the radiator—or—the discharge grille shall be installed in the wood sill by others. The valves shall have extension stems installed on the sill.

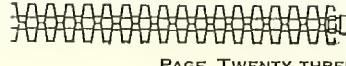
Grilles by Others

The top grille in all cases should be at least the width and length of the radiator, valve and trap, with approximately 75% free area. The bottom grille should have a free area equal to 75% of the top grille. Where grilles having less than 75% free area are used, they should be increased in size accordingly. Doors shall be provided in the grilles for access to the valve and trap.



MURRAY PATENTS

MURRAY RADIATOR CORPORATION

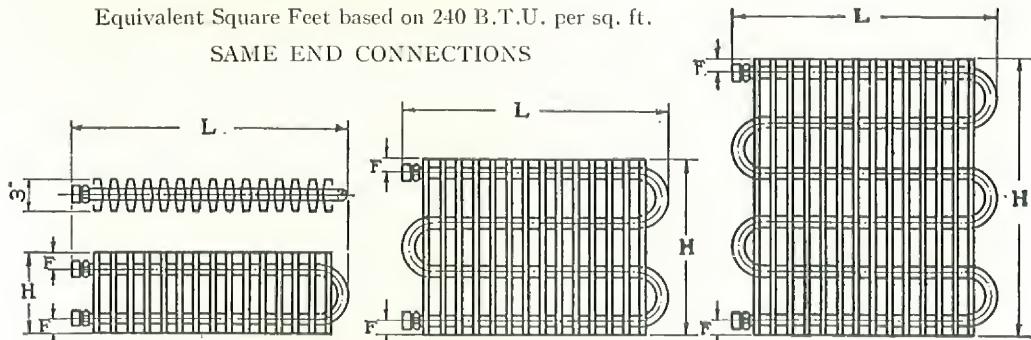


PAGE TWENTY-THREE

3" Flue Murray Radiator

Equivalent Square Feet based on 240 B.T.U. per sq. ft.

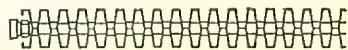
SAME END CONNECTIONS



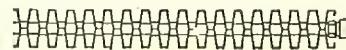
7 1/2" and 9 1/2" Radiators 16 1/2" and 18 1/2" Radiators 25 1/2" and 27 1/2" Radiators

Above heights do not include legs. Add height of legs to dimension "H"

Sections	F	1 1/2"	2 1/2"	1 1/2"	2 1/2"	1 1/2"	2 1/2"
		Sq. Ft. Per Sec.	.67	.77	1.09	1.18	1.54
"L" in inches	H-7 1/2"	H-9 1/2"	H-16 1/2"	H-18 1/2"	H-25 1/2"	H-27 1/2"	
8	14 1/2	5.4	6.1	8.7	9.4	12.3	13.1
10	17 1/2	6.7	7.7	10.9	11.8	15.4	16.4
12	20 1/2	8.0	9.2	13.1	14.2	18.5	19.7
14	23 1/2	9.4	10.8	15.8	16.5	21.6	23.0
16	26 1/2	10.7	12.3	17.4	18.9	24.6	26.2
18	29 1/2	12.1	13.9	19.6	21.2	27.7	29.5
20	32 1/2	13.4	15.4	21.8	23.6	30.8	32.8
22	35 1/2	14.7	16.9	24.0	26.0	33.9	36.1
24	38 1/2	16.1	18.5	26.2	28.3	37.0	39.4
26	41 1/2	17.4	20.0	28.3	30.7	40.0	42.6
28	44 1/2	18.8	21.6	30.5	33.0	43.0	45.9
30	47 1/2	20.1	23.1	32.7	35.4	46.2	49.2
32	50 1/2	21.4	24.6	34.9	37.8	49.3	52.5
34	53 1/2	22.8	26.2	37.1	40.1	52.3	55.8
36	56 1/2	24.1	27.7	39.2	42.5	55.4	59.0
38	59 1/2	25.5	29.3	41.4	44.8	58.5	62.3
40	62 1/2	26.8	30.8	43.6	47.2	61.6	65.6
42	65 1/2	28.1	32.3	45.8	49.6	64.7	68.9
44	68 1/2	29.5	33.9	48.0	51.9	67.8	72.2
46	71 1/2	30.8	35.4	50.1	54.3	70.8	75.4
48	74 1/2	32.2	37.0	52.3	56.6	73.9	78.7
50	77 1/2	33.5	38.5	54.5	59.0	77.0	82.0
52	80 1/2	34.8	40.0	56.7	61.4	80.1	85.3
54	83 1/2	36.2	41.6	58.9	63.7	83.2	88.6
56	86 1/2	37.5	43.1	61.0	66.1	86.2	91.8
58	89 1/2	38.9	44.7	63.2	68.4	89.3	95.1
60	92 1/2	40.2	46.2	65.4	70.8	92.4	98.4



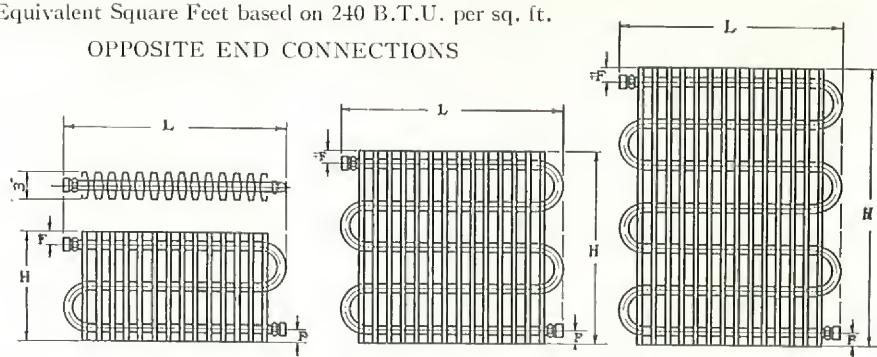
MURRAY RADIATOR CORPORATION



3" Flue Murray Radiator

Equivalent Square Feet based on 240 B.T.U. per sq. ft.

OPPOSITE END CONNECTIONS



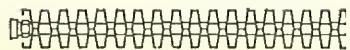
12" and 14" Radiators

21" and 23" Radiators

30" and 32" Radiators

Above heights do not include legs. Add height of legs to dimension "H"

Sections	F	1½"	2½"	1½"	2½"	1½"	2½"
	Sq. Ft. Per Sec.	.89	1.00	1.31	1.41	1.76	1.86
"L" in inches	H-12"	H-14"	H-21"	H-23"	H-30"	H-32"	
8	14½	7.1	8.0	10.5	11.3	14.1	14.9
10	17½	8.9	10.0	13.1	14.1	17.6	18.6
12	20½	10.7	12.0	15.7	16.9	21.1	22.3
14	23½	12.5	14.0	18.3	19.7	24.6	26.0
16	26½	14.2	16.0	21.0	22.6	28.2	29.8
18	29½	16.0	18.0	23.6	25.4	31.7	33.5
20	32½	17.8	20.0	26.2	28.2	35.2	37.2
22	35½	19.6	22.0	28.8	31.0	38.7	40.9
24	38½	21.4	24.0	31.4	33.8	42.2	44.6
26	41½	23.1	26.0	34.1	36.7	45.8	48.4
28	44½	24.9	28.0	36.7	39.5	49.3	52.1
30	47½	26.7	30.0	39.3	42.3	52.8	55.8
32	50½	28.5	32.0	41.9	45.1	56.3	59.5
34	53½	30.3	34.0	44.5	47.9	59.8	63.2
36	56½	32.0	36.0	47.2	50.8	63.4	67.0
38	59½	33.8	38.0	49.8	53.6	66.9	70.7
40	62½	35.6	40.0	52.4	56.4	70.4	74.4
42	65½	37.4	42.0	55.0	59.2	73.9	78.1
44	68½	39.2	44.0	57.6	62.0	77.4	81.8
46	71½	40.9	46.0	60.3	64.9	81.0	85.6
48	74½	42.7	48.0	62.9	67.7	84.5	89.3
50	77½	44.5	50.0	65.5	70.5	88.0	93.0
52	80½	46.3	52.0	68.1	73.3	91.5	96.7
54	83½	48.1	54.0	70.7	76.1	95.0	100.4
56	86½	49.8	56.0	73.4	79.0	98.6	104.2
58	89½	51.6	58.0	76.0	81.8	102.1	107.9
60	92½	53.4	60.0	78.6	84.6	105.6	111.6



MURRAY RADIATOR CORPORATION

MURRAY PATENTS

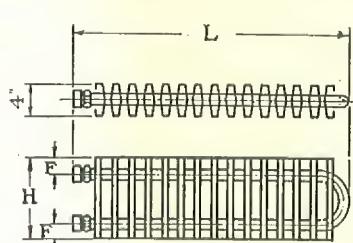


PAGE TWENTY-FIVE

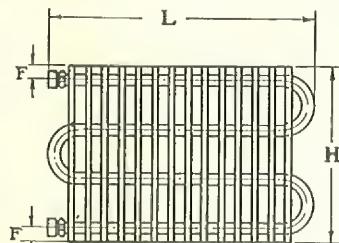
4" Flue Murray Radiator

Equivalent Square Feet based on 240 B.T.U. per sq. ft.

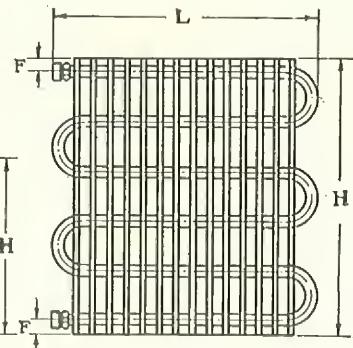
SAME END CONNECTIONS



7 1/2" and 9 1/2" Radiators



16 1/2" and 18 1/2" Radiators



25 1/2" and 27 1/2" Radiators

Above heights do not include legs. Add height of legs to dimension "H"

	F	11 1/2"	21 1/2"	11 1/2"	21 1/2"	11 1/2"	21 1/2"
	Sq. Ft. Per Sec.	.81	.93	1.20	1.4	1.77	1.87
Sections	"L" in inches	H-7 1/2"	H-9 1/2"	H-16 1/2"	H-18 1/2"	H-25 1/2"	H-27 1/2"
8	14 1/2	6.5	7.4	10.3	11.2	14.2	15.0
10	17 1/2	8.1	9.3	12.9	14.0	17.7	18.7
12	20 1/2	9.7	11.2	15.5	16.8	21.3	22.5
14	23 1/2	11.3	13.0	18.1	19.6	24.8	26.2
16	26 1/2	13.0	14.9	20.6	22.4	28.4	30.0
18	29 1/2	14.6	16.7	23.2	25.2	32.0	33.7
20	32 1/2	16.2	18.6	25.8	28.0	35.4	37.4
22	35 1/2	17.8	20.5	28.4	30.8	39.0	41.2
24	38 1/2	19.4	22.3	31.0	33.6	42.5	44.9
26	41 1/2	21.1	24.2	33.5	36.4	46.1	48.7
28	44 1/2	22.7	26.0	36.1	39.2	49.6	52.4
30	47 1/2	24.3	27.9	38.7	42.0	53.1	56.1
32	50 1/2	25.9	29.8	41.3	44.8	56.7	59.9
34	53 1/2	27.5	31.6	43.9	47.6	60.2	63.6
36	56 1/2	29.2	33.5	46.4	50.4	63.8	67.4
38	59 1/2	30.8	35.3	49.0	53.2	67.3	71.1
40	62 1/2	32.4	37.2	51.6	56.0	70.8	74.8
42	65 1/2	34.1	39.1	54.2	58.8	74.4	78.6
44	68 1/2	35.6	40.9	56.8	61.6	77.9	82.3
46	71 1/2	37.3	42.8	59.3	64.4	81.5	86.6
48	74 1/2	38.9	44.6	61.9	67.2	85.0	89.8
50	77 1/2	40.5	46.5	64.5	70.0	88.5	93.5
52	80 1/2	42.1	48.4	67.1	72.8	92.1	97.3
54	83 1/2	43.7	50.2	69.7	75.6	95.6	101.2
56	86 1/2	45.4	52.1	72.2	78.4	99.2	104.8
58	89 1/2	47.0	53.9	74.8	81.2	102.7	108.5
60	92 1/2	48.6	55.8	77.4	84.0	106.2	112.2



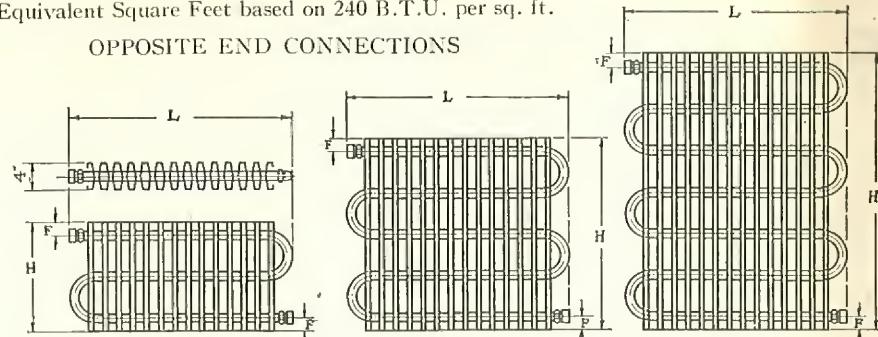
MURRAY RADIATOR CORPORATION



4" Flue Murray Radiator

Equivalent Square Feet based on 240 B.T.U. per sq. ft.

OPPOSITE END CONNECTIONS



12" and 14" Radiators

21" and 23" Radiators

30" and 32" Radiators

Above heights do not include legs. Add height of legs to dimension "H"

Sections	F Sq. Ft. Per Sec.	1½"	2½"	1½"	2½"	1½"	2½"
		H-12"	H-14"	H-21"	H-23"	H-30"	H-32"
		"L" in inches					
8	14½	8.4	9.4	12.2	13.1	16.0	16.8
10	17½	10.5	11.7	15.3	16.4	20.0	21.0
12	20½	12.6	14.0	18.3	19.7	24.0	25.2
14	23½	14.7	16.4	21.4	22.9	28.0	29.4
16	26½	16.8	18.7	24.4	26.2	32.0	33.6
18	29½	18.9	21.0	27.5	29.5	36.0	37.8
20	32½	21.0	23.4	30.6	32.8	40.0	42.0
22	35½	23.1	25.7	33.6	36.1	44.0	46.2
24	38½	25.2	28.0	36.7	39.3	48.0	50.4
26	41½	27.3	30.4	39.7	42.6	52.0	54.6
28	44½	29.4	32.8	42.8	45.9	56.0	58.8
30	47½	31.5	35.1	45.9	49.2	60.0	63.0
32	50½	33.6	37.4	48.9	52.5	64.0	67.2
34	53½	35.7	39.8	52.0	55.7	68.0	71.4
36	56½	37.8	42.1	55.0	59.0	72.0	75.6
38	59½	39.9	44.5	58.1	62.3	76.0	79.8
40	62½	42.0	46.8	61.2	65.6	80.0	84.0
42	65½	44.1	49.1	64.2	68.9	84.0	88.2
44	68½	46.2	51.5	67.3	72.1	88.0	92.4
46	71½	48.3	53.8	70.3	75.4	92.0	96.6
48	74½	50.4	56.2	73.4	78.7	96.0	100.8
50	77½	52.5	58.5	76.5	82.0	100.0	105.0
52	80½	54.6	60.8	79.5	85.3	104.0	109.2
54	83½	56.7	63.2	82.6	88.5	108.0	113.4
56	86½	58.8	65.5	85.6	91.8	112.0	117.6
58	89½	60.9	67.9	88.7	95.1	116.0	121.8
60	92½	63.0	70.2	91.8	98.4	120.0	126.0



MURRAY PATENTS

MURRAY RADIATOR CORPORATION

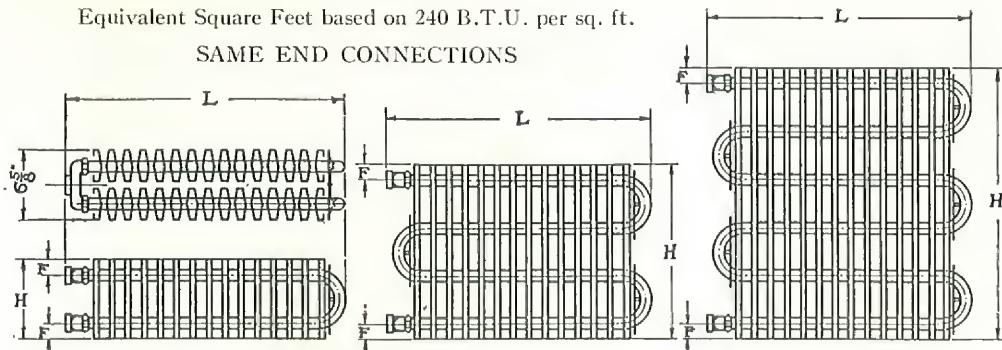


PAGE TWENTY-SEVEN

6-5/8" Flue Murray Radiator

Equivalent Square Feet based on 240 B.T.U. per sq. ft.

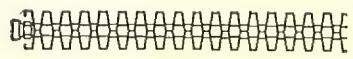
SAME END CONNECTIONS



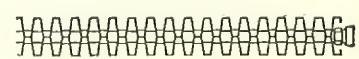
7 1/2" and 9 1/2" Radiators 16 1/2" and 18 1/2" Radiators 25 1/2" and 27 1/2" Radiators

Above heights do not include legs. Add height of legs to dimension "H"

Sections	F	1 1/2"	2 1/2"	1 1/2"	2 1/2"	1 1/2"	2 1/2"
	Sq. Ft. Per Sec.	1.27	1.46	2.08	2.26	2.92	3.12
8	15	10.2	11.7	16.6	18.1	23.4	25.0
10	18	12.7	14.6	20.8	22.6	29.2	31.2
12	21	15.2	17.5	25.0	27.1	35.0	37.4
14	24	17.8	20.4	29.1	31.6	40.9	43.7
16	27	20.3	23.4	33.3	36.2	46.7	49.9
18	30	22.9	26.3	37.4	40.7	52.6	56.2
20	33	25.4	29.2	41.6	45.2	58.4	62.4
22	36	27.9	32.1	45.8	49.7	64.2	68.6
24	39	30.5	35.0	49.9	54.2	70.0	74.9
26	42	33.0	38.0	54.1	58.8	75.9	81.1
28	45	35.6	40.9	58.2	63.3	81.8	87.4
30	48	38.1	43.8	62.4	67.8	87.6	93.6
32	51	40.6	46.7	66.6	72.3	93.4	99.8
34	54	43.2	49.6	70.7	76.8	99.3	106.0
36	57	45.7	52.6	74.9	81.4	105.1	112.3
38	60	48.3	55.5	79.0	85.9	111.0	118.6
40	63	50.8	58.4	83.2	90.4	116.8	124.8
42	66	53.3	61.3	87.4	94.9	122.6	131.0
44	69	55.9	64.2	91.5	99.4	128.5	137.3
46	72	58.4	67.2	95.7	104.0	134.3	143.5
48	75	61.0	70.1	99.8	108.5	140.2	149.8
50	78	63.5	73.0	104.0	113.0	146.0	156.0
52	81	66.0	75.9	108.2	117.5	151.8	162.2
54	84	68.6	78.8	112.3	122.0	157.7	168.5
56	87	71.1	81.8	116.5	126.6	163.5	174.7
58	90	73.7	84.7	120.6	131.0	169.4	181.0
60	93	76.2	87.6	124.8	135.6	175.2	187.2



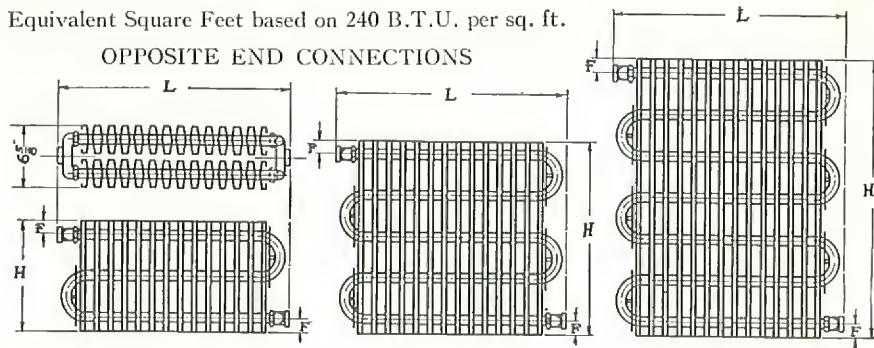
MURRAY RADIATOR CORPORATION



6-5/8" Flue Murray Radiator

Equivalent Square Feet based on 240 B.T.U. per sq. ft.

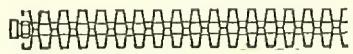
OPPOSITE END CONNECTIONS



12" and 14" Radiators 21" and 23" Radiators 30" and 32" Radiators

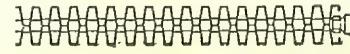
Above heights do not include legs. Add height of legs to dimension "H"

Sections	F	1½"	2½"	1½"	2½"	1½"	2½"
		Sq. Ft. Per Sec.	1.69	1.89	2.50	2.69	3.34
"L" in inches	H-12"	H-14"	H-21"	H-23"	H-30"	H-32"	
8	15½	13.5	15.1	20.0	21.5	26.7	28.3
10	18½	16.9	18.9	25.0	26.9	33.4	35.4
12	21½	20.3	22.7	30.0	32.3	40.1	42.5
14	24½	23.7	26.5	35.0	37.7	46.8	49.5
16	27½	27.0	30.2	40.0	43.0	53.4	56.6
18	30½	30.4	34.0	45.0	48.4	60.1	63.7
20	33½	33.8	37.8	50.0	53.8	66.8	70.8
22	36½	37.2	41.6	55.0	59.2	73.5	77.9
24	39½	40.6	45.4	60.0	64.6	80.2	84.9
26	42½	43.9	49.1	65.0	69.9	86.8	92.0
28	45½	47.3	52.9	70.0	75.3	93.5	99.1
30	48½	50.7	56.7	75.0	80.7	100.2	106.2
32	51½	54.0	60.5	80.0	86.1	106.9	113.3
34	54½	57.5	65.3	85.0	91.5	113.6	120.3
36	57½	60.8	68.0	90.0	96.8	120.2	127.4
38	60½	64.2	71.8	95.0	102.2	126.9	134.5
40	63½	67.6	75.6	100.0	107.6	133.6	141.6
42	66½	71.0	79.4	105.0	113.0	140.3	148.7
44	69½	74.4	83.2	110.0	118.4	147.0	155.7
46	72½	77.7	86.9	115.0	123.7	153.6	162.8
48	75½	81.1	90.7	120.0	129.1	160.3	169.9
50	78½	84.5	94.5	125.0	134.5	167.0	177.0
52	81½	87.9	98.3	130.0	139.9	173.7	184.1
54	84½	91.3	102.0	135.0	145.3	180.4	191.1
56	87½	94.6	105.8	140.0	150.6	187.0	198.2
58	90½	98.0	109.6	145.0	156.0	193.7	205.3
60	93½	101.4	113.4	150.0	161.4	200.4	212.4



MURRAY PATENTS

MURRAY RADIATOR CORPORATION

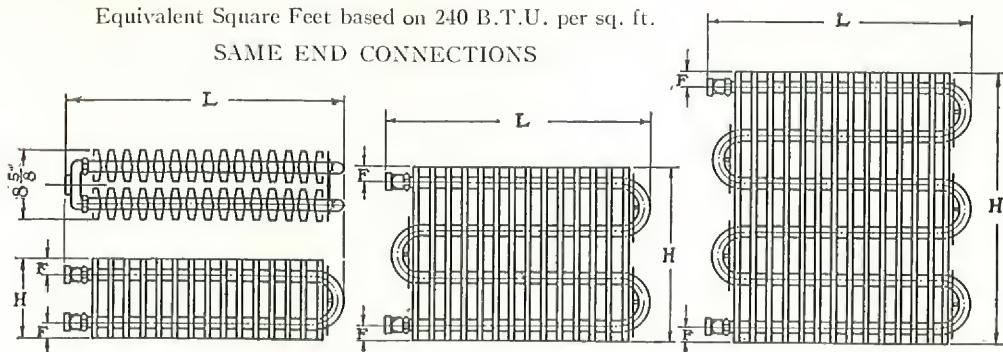


PAGE TWENTY-NINE

8-5/8" Flue Murray Radiator

Equivalent Square Feet based on 240 B.T.U. per sq. ft.

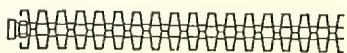
SAME END CONNECTIONS



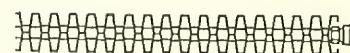
7 1/2" and 9 1/2" Radiators 16 1/2" and 18 1/2" Radiators 25 1/2" and 27 1/2" Radiators

Above heights do not include legs. Add height of legs to dimension "H"

Sections	F	1 1/2"	2 1/2"	3 1/2"	4 1/2"	5 1/2"	6 1/2"
	Sq. Ft. Per Sec.	1.52	1.75	2.45	2.65	3.38	3.60
	"L" in inches	H-7 1/2"	H-9 1/2"	H-16 1/2"	H-18 1/2"	H-25 1/2"	H-27 1/2"
8	15	12.2	14.0	19.6	21.2	27.0	28.8
10	18	15.2	17.5	24.5	26.5	33.8	36.0
12	21	18.2	21.0	29.4	31.8	40.6	43.2
14	24	21.3	24.5	34.3	37.1	47.3	50.4
16	27	24.3	28.0	39.2	42.4	54.0	57.6
18	30	27.4	31.5	44.1	47.7	60.8	64.8
20	33	30.4	35.0	49.0	53.0	67.6	72.0
22	36	33.4	38.5	53.9	58.3	74.4	79.2
24	39	36.5	42.0	58.8	63.6	81.1	86.4
26	42	39.0	45.5	63.7	68.9	87.9	93.6
28	45	42.6	49.0	68.6	74.2	94.6	100.8
30	48	45.6	52.5	73.5	79.5	101.4	108.0
32	51	48.6	56.0	78.4	84.8	108.2	115.2
34	54	51.7	59.5	83.3	90.1	114.9	122.4
36	57	54.7	63.0	88.2	95.4	121.7	129.6
38	60	57.8	66.5	93.1	100.7	128.4	136.8
40	63	60.8	70.0	98.0	106.0	135.2	144.0
42	66	63.8	73.5	102.9	113.0	142.0	151.2
44	69	66.9	77.0	107.8	116.6	148.7	158.4
46	72	69.9	80.5	112.7	121.9	155.5	165.6
48	75	73.0	84.0	117.6	127.2	162.0	172.8
50	78	76.0	87.5	122.5	132.5	169.0	180.0
52	81	79.0	91.0	127.4	137.8	175.8	187.2
54	84	82.1	94.5	132.3	143.1	182.5	194.4
56	87	85.1	98.0	137.2	148.4	189.3	201.6
58	90	88.2	101.5	142.1	153.7	196.0	208.8
60	93	91.2	105.0	147.0	159.0	202.1	216.0



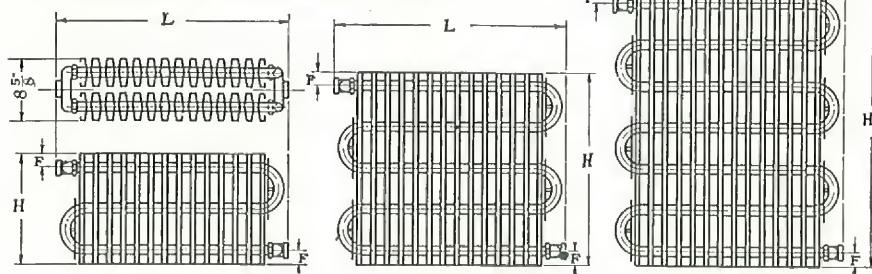
MURRAY RADIATOR CORPORATION



8 $\frac{5}{8}$ " Flue Murray Radiator

Equivalent Square Feet based on 240 B.T.U. per sq. ft.

OPPOSITE END CONNECTIONS



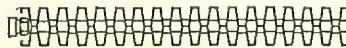
12" and 14" Radiators

21" and 23" Radiators

30" and 32" Radiators

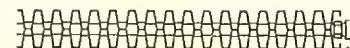
Above heights do not include legs. Add height of legs to dimension "H"

Sections	F	1 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "
	Sq. Ft. Per Sec.	2.00	2.20	2.90	3.12	3.85	4.05
8	15 $\frac{1}{2}$	16.0	17.6	23.2	25.0	31.8	32.4
10	18 $\frac{1}{2}$	20.0	22.0	29.0	31.2	38.5	40.5
12	21 $\frac{1}{2}$	24.0	26.4	34.8	37.4	46.2	48.6
14	24 $\frac{1}{2}$	28.0	30.8	40.6	43.7	53.9	56.7
16	27 $\frac{1}{2}$	32.0	35.2	46.4	49.9	61.6	64.8
18	30 $\frac{1}{2}$	36.0	39.6	52.2	56.2	69.3	72.9
20	33 $\frac{1}{2}$	40.0	44.0	58.0	62.4	77.0	81.0
22	36 $\frac{1}{2}$	44.0	48.4	63.8	68.6	84.7	89.1
24	39 $\frac{1}{2}$	48.0	52.8	69.6	74.9	92.4	97.2
26	42 $\frac{1}{2}$	52.0	57.2	75.4	81.1	100.0	105.3
28	45 $\frac{1}{2}$	56.0	61.6	81.2	87.4	107.8	113.4
30	48 $\frac{1}{2}$	60.0	66.0	87.0	93.6	115.5	121.5
32	51 $\frac{1}{2}$	64.0	70.4	92.8	99.8	123.2	129.6
34	54 $\frac{1}{2}$	68.0	74.8	98.6	106.1	130.9	137.7
36	57 $\frac{1}{2}$	72.0	79.2	104.4	112.3	138.6	145.8
38	60 $\frac{1}{2}$	76.0	83.6	110.2	118.6	146.3	153.9
40	63 $\frac{1}{2}$	80.0	88.0	116.0	124.8	154.0	162.0
42	66 $\frac{1}{2}$	84.0	92.4	121.8	131.0	161.7	170.1
44	69 $\frac{1}{2}$	88.0	96.8	127.6	137.3	169.4	178.2
46	72 $\frac{1}{2}$	92.0	101.2	133.4	143.5	177.1	186.3
48	75 $\frac{1}{2}$	96.0	105.6	139.2	149.8	184.8	194.4
50	78 $\frac{1}{2}$	100.0	110.0	145.0	156.0	192.5	202.5
52	81 $\frac{1}{2}$	104.0	114.4	150.8	162.2	200.0	210.6
54	84 $\frac{1}{2}$	108.0	118.8	156.6	168.5	207.9	218.7
56	87 $\frac{1}{2}$	112.0	123.2	162.4	174.7	215.6	226.8
58	90 $\frac{1}{2}$	116.0	127.6	168.2	181.0	223.3	234.9
60	93 $\frac{1}{2}$	120.0	132.0	174.0	187.2	231.0	243.0



MURRAY PATENTS

MURRAY RADIATOR CORPORATION

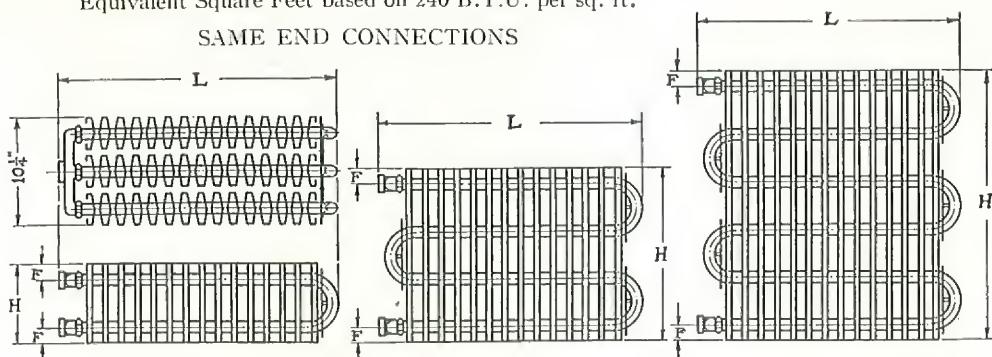


PAGE THIRTY-ONE

10-1/4" Flue Murray Radiator

Equivalent Square Feet based on 240 B.T.U. per sq. ft.

SAME END CONNECTIONS



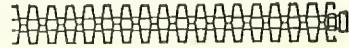
7½" and 9½" Radiators 16½" and 18½" Radiators 25½" and 27½" Radiators

Above heights do not include legs. Add height of legs to dimension "H"

Sections	F	1½"	2½"	1½"	2½"	1½"	2½"
		Sq. Ft. Per Sec.	1.87	2.16	3.06	3.35	4.31
	"L" in inches	H-7½"	H-9½"	H-16½"	H-18½"	H-25½"	H-27½"
8	15	15.0	17.3	24.5	26.8	34.5	37.8
10	18	18.7	21.6	30.6	33.5	43.1	47.3
12	21	22.4	25.9	36.7	40.2	51.7	56.8
14	24	26.2	30.2	42.8	46.9	60.3	66.2
16	27	29.9	34.6	49.0	53.6	69.0	75.7
18	30	33.7	38.9	55.1	60.3	77.6	85.1
20	33	37.4	43.2	61.2	67.0	86.2	94.6
22	36	41.1	47.5	67.3	73.7	94.8	104.1
24	39	44.9	51.8	73.4	80.4	103.4	113.5
26	42	48.6	56.2	79.6	87.1	112.1	123.0
28	45	52.4	60.5	85.7	93.8	120.7	132.4
30	48	56.1	64.8	91.8	100.5	129.3	141.9
32	51	59.8	69.1	97.9	107.2	137.9	151.4
34	54	63.6	73.4	104.0	113.9	146.5	160.8
36	57	67.3	77.8	110.2	120.6	155.2	170.3
38	60	71.1	82.1	116.3	127.3	163.8	179.7
40	63	74.8	86.4	122.4	134.0	172.4	189.2
42	66	78.5	90.7	128.5	140.7	181.0	198.7
44	69	82.3	95.0	134.6	147.4	189.6	208.1
46	72	86.0	99.4	140.8	154.1	198.3	217.6
48	75	89.8	103.7	146.9	160.8	206.9	227.0
50	78	93.5	108.0	153.0	167.5	215.5	236.5
52	81	97.2	112.3	159.1	174.2	224.1	246.0
54	84	101.0	116.6	165.2	180.9	232.7	255.4
56	87	104.7	121.0	171.4	187.6	241.4	264.9
58	90	108.5	125.3	177.5	194.3	250.0	274.3
60	93	112.2	129.6	183.6	201.0	258.6	283.8



MURRAY RADIATOR CORPORATION

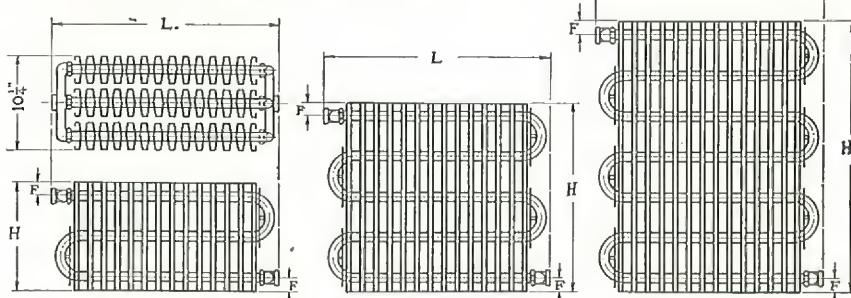


MURRAY PATENTS

10-1/4" Flue Murray Radiator

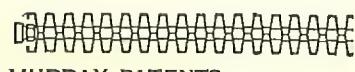
Equivalent Square Feet based on 240 B.T.U. per sq. ft.

OPPOSITE END CONNECTIONS



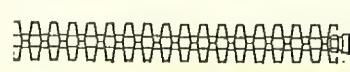
12" and 14" Radiators 21" and 23" Radiators 30" and 32" Radiators
Above heights do not include legs. Add height of legs to dimension "H"

Sections	F Sq. Ft. Per Sec.	1 1/2"	2 1/2"	1 1/2"	2 1/2"	1 1/2"	2 1/2"
		"L" in inches	H-12"	H-14"	H-21"	H-23"	H-30"
8	15 1/2	19.8	22.2	29.4	31.7	39.3	41.7
10	18 1/2	24.8	27.7	36.8	39.6	49.1	52.1
12	21 1/2	29.8	33.2	44.2	47.5	58.9	62.5
14	24 1/2	34.7	38.8	51.5	55.4	68.7	72.9
16	27 1/2	39.7	44.3	58.9	63.4	78.6	83.4
18	30 1/2	44.6	49.9	66.2	71.3	88.4	93.8
20	33 1/2	49.6	55.4	73.6	79.2	98.2	104.2
22	36 1/2	54.6	60.9	81.0	87.1	108.0	114.6
24	39 1/2	59.5	66.5	88.3	95.0	117.8	125.0
26	42 1/2	64.5	72.0	95.7	103.0	127.7	135.5
28	45 1/2	69.4	77.6	103.0	110.9	137.5	145.9
30	48 1/2	74.4	83.1	110.4	118.8	147.3	156.3
32	51 1/2	79.4	88.6	117.8	126.7	157.1	166.7
34	54 1/2	84.3	94.2	125.1	134.6	166.9	177.1
36	57 1/2	89.3	99.7	132.5	142.6	176.8	187.6
38	60 1/2	94.2	105.3	139.8	150.5	186.6	198.0
40	63 1/2	99.2	110.8	147.2	158.4	196.4	208.4
42	66 1/2	104.2	116.3	154.6	166.3	206.2	218.8
44	69 1/2	109.1	121.9	161.9	174.2	216.0	229.2
46	72 1/2	114.1	127.4	169.3	182.2	225.9	239.7
48	75 1/2	119.1	133.0	176.6	190.1	235.7	250.1
50	78 1/2	124.0	138.5	184.0	198.0	245.5	260.5
52	81 1/2	129.0	144.0	191.4	205.9	255.3	270.9
54	84 1/2	133.9	149.6	198.7	213.8	265.1	281.3
56	87 1/2	138.9	155.1	206.1	221.8	275.0	291.8
58	90 1/2	143.8	160.7	213.4	229.7	284.8	302.2
60	92 1/2	148.8	166.2	220.8	237.6	294.6	312.6



MURRAY PATENTS

MURRAY RADIATOR CORPORATION

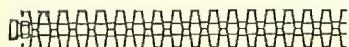
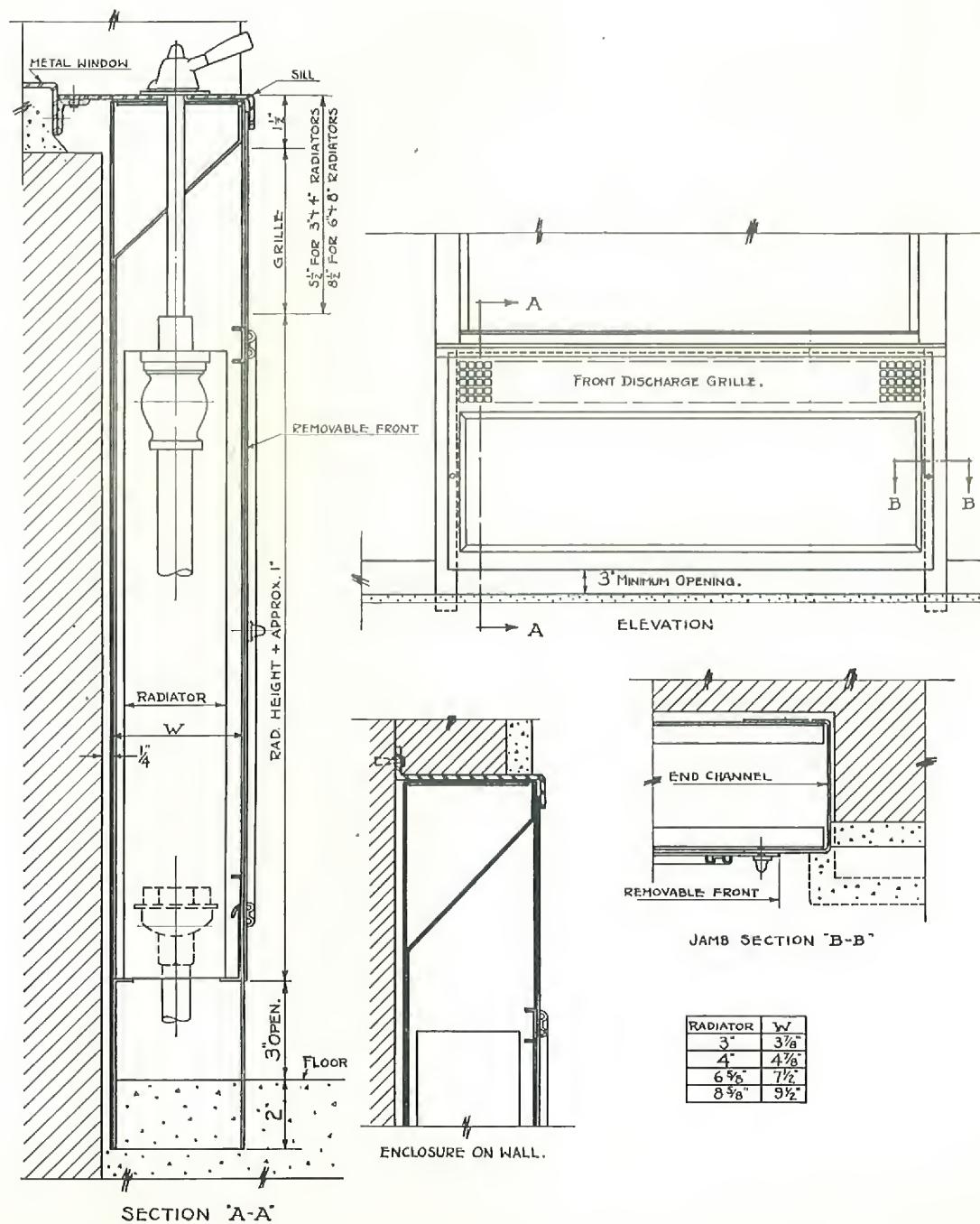


PAGE THIRTY-THREE

Murray Radiator Enclosure

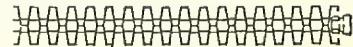
Typical Office Building Type

Front Discharge



MURRAY RADIATOR CORPORATION

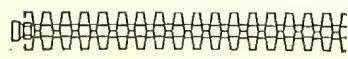
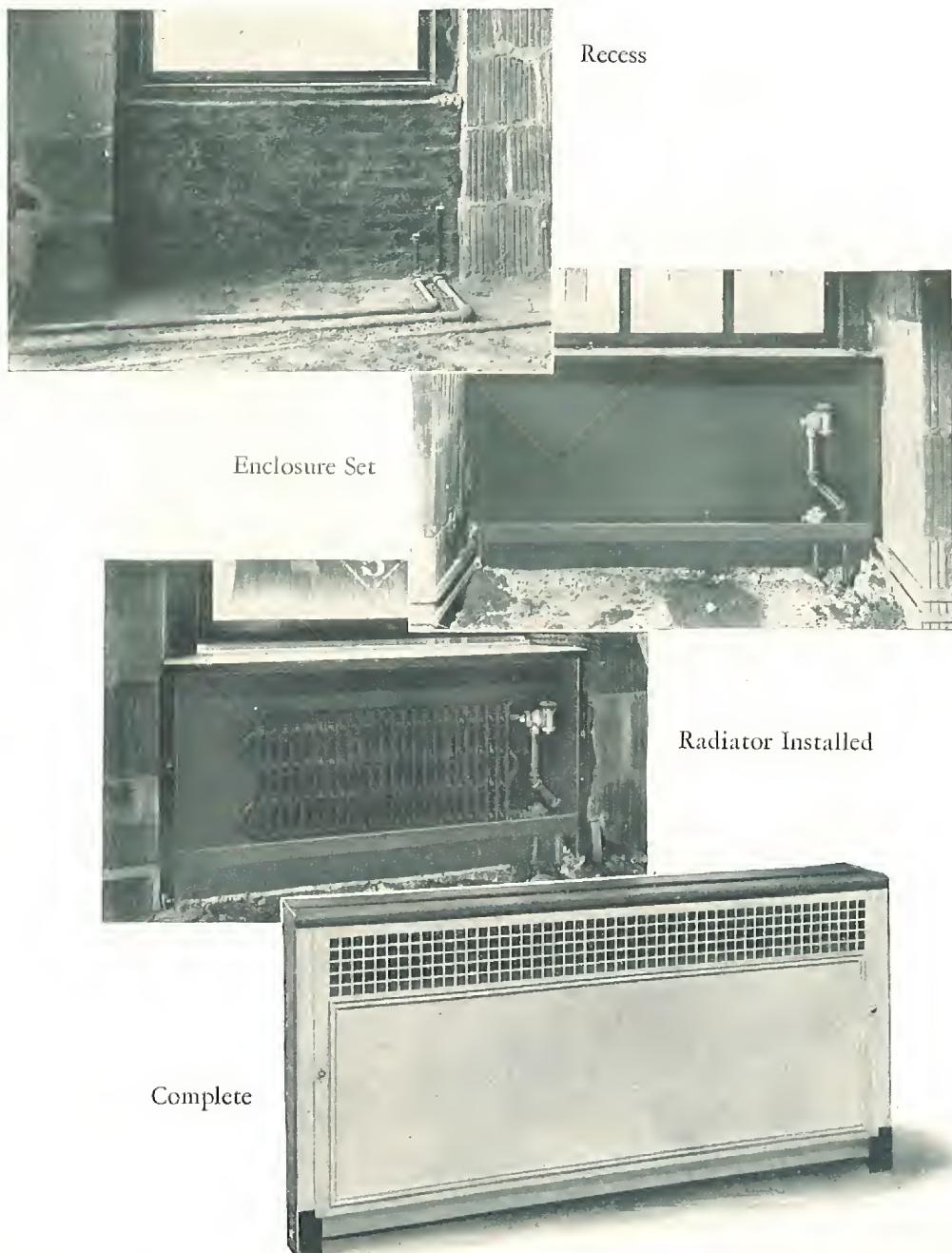
PAGE THIRTY-FOUR



MURRAY PATENTS

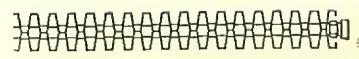
Installation of Office Building Enclosure

Detailed on Previous Page



MURRAY PATENTS

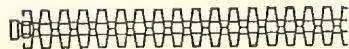
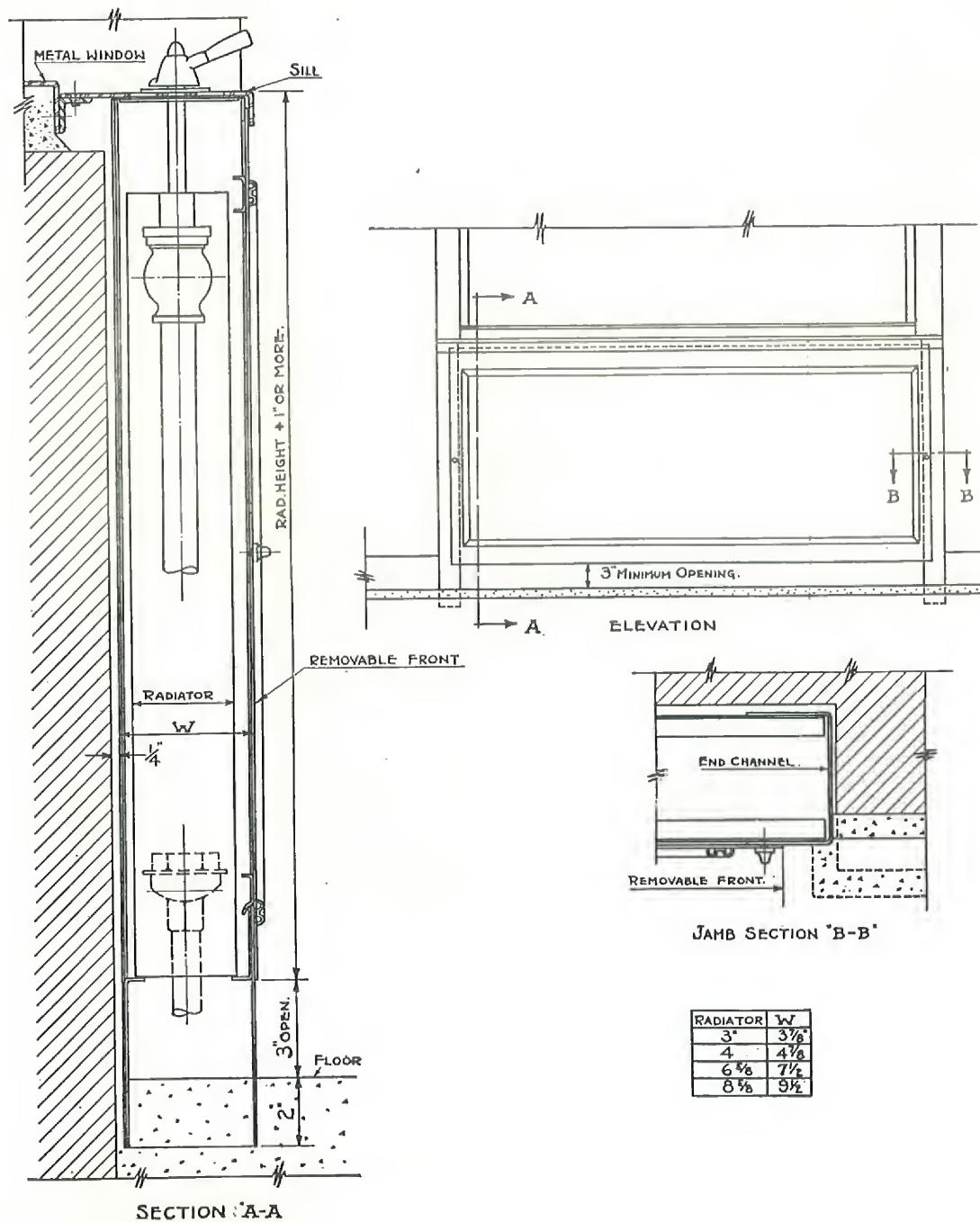
MURRAY RADIATOR CORPORATION



PAGE THIRTY-FIVE

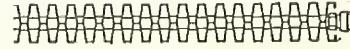
Murray Radiator Enclosure

Typical Office Building Type
Top Discharge



MURRAY RADIATOR CORPORATION

PAGE THIRTY-SIX

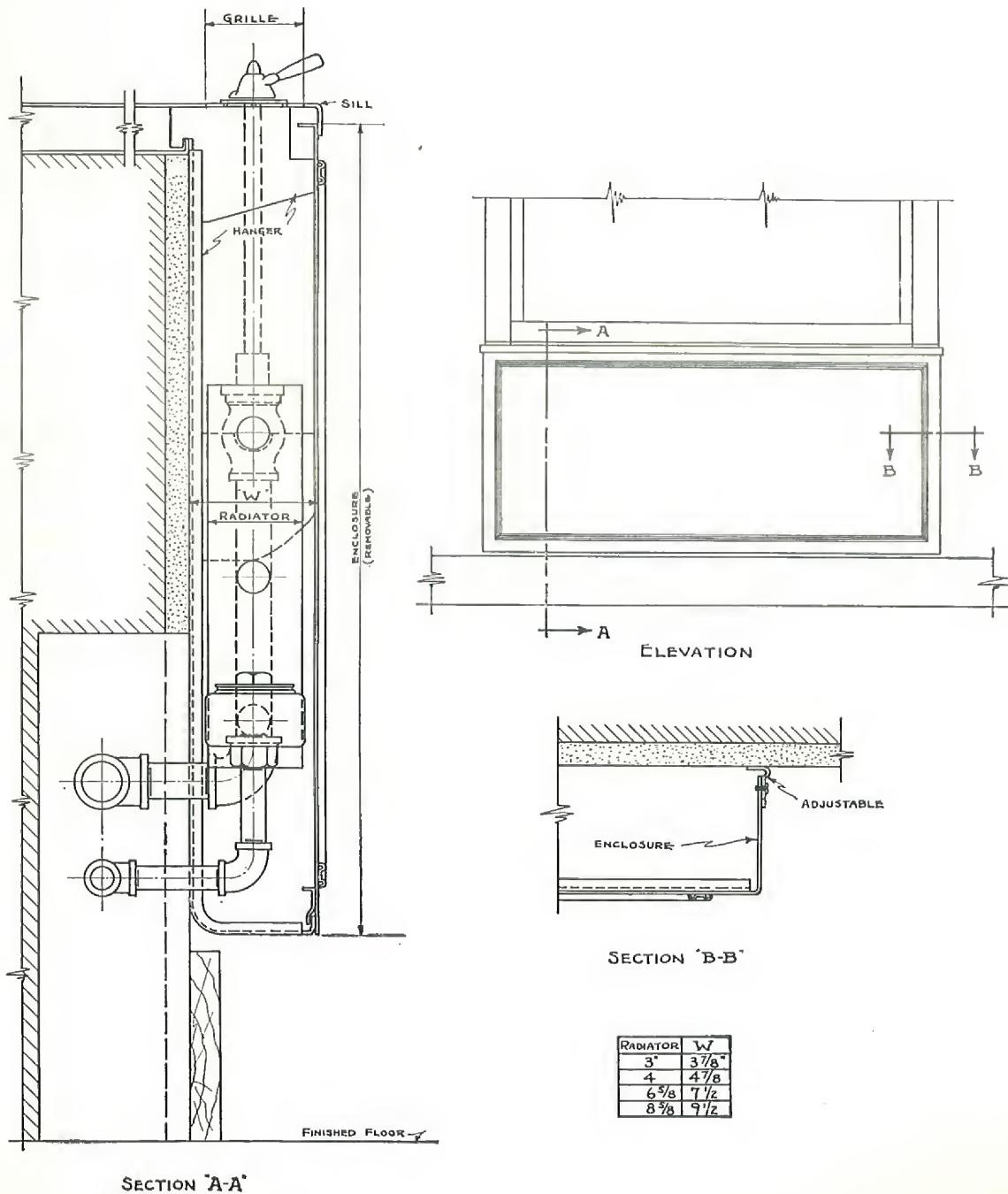


MURRAY PATENTS

Murray Radiator Enclosure

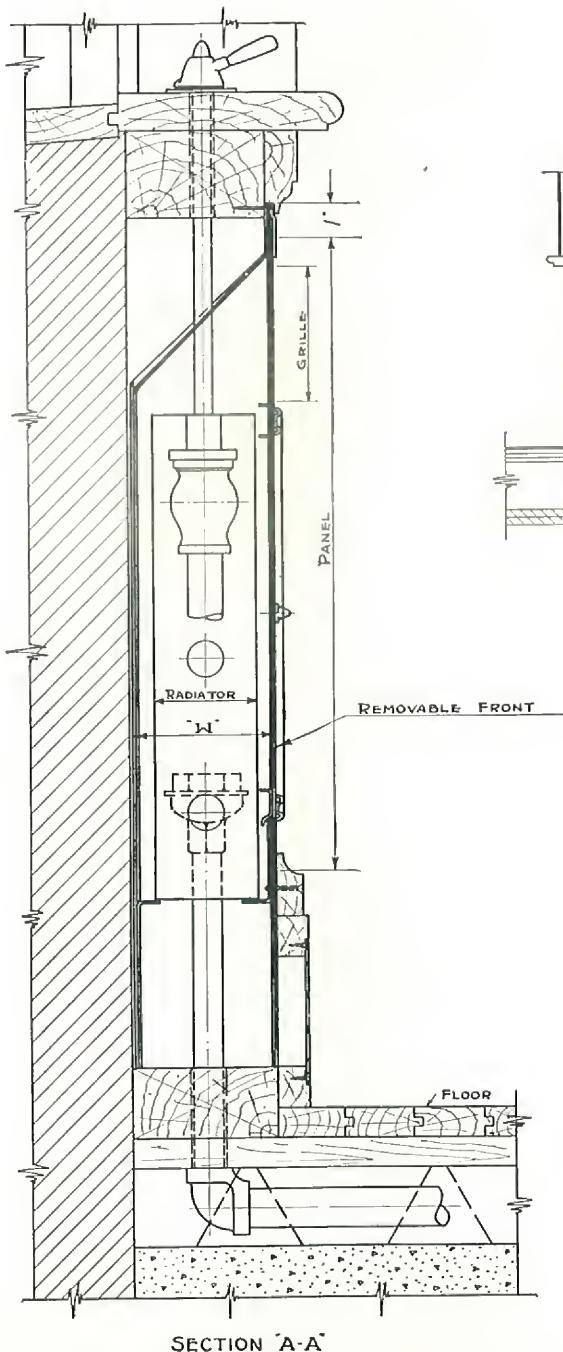
Typical Office Building Type

Top Discharge

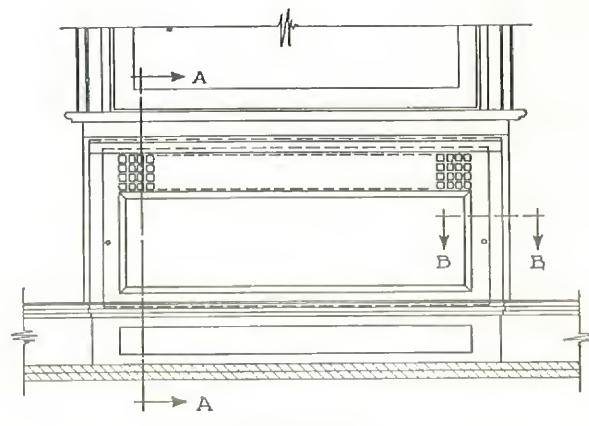


Murray Radiator Enclosure

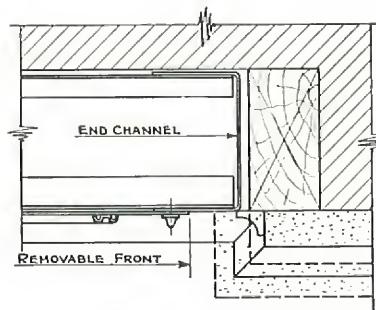
Typical Apartment House Type



SECTION 'A-A'



ELEVATION



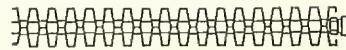
JAMB SECTION 'B-B'

RADIATOR	W
3'	3 $\frac{1}{8}$
4'	4 $\frac{1}{8}$
6 $\frac{5}{8}$	7 $\frac{1}{2}$
8 $\frac{5}{8}$	9 $\frac{1}{2}$



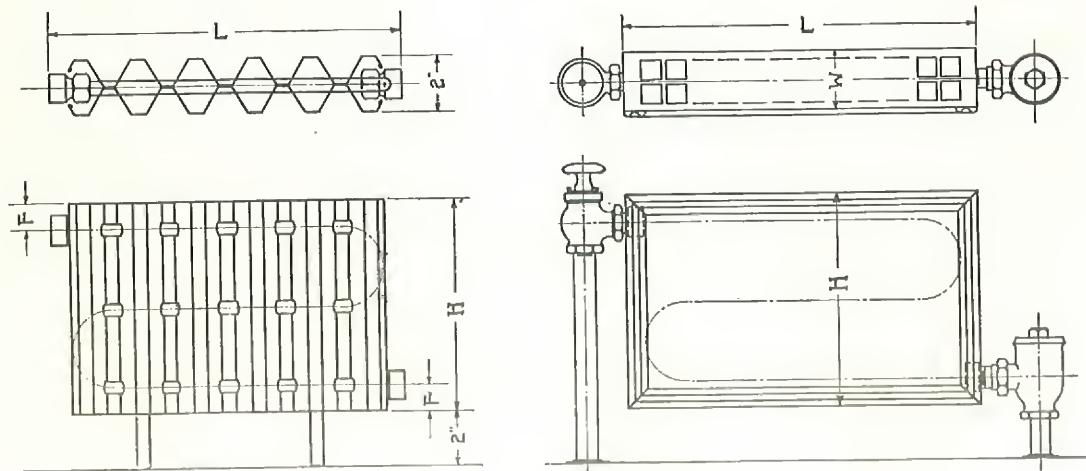
PAGE THIRTY-EIGHT

MURRAY RADIATOR CORPORATION



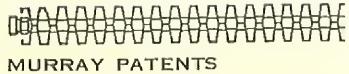
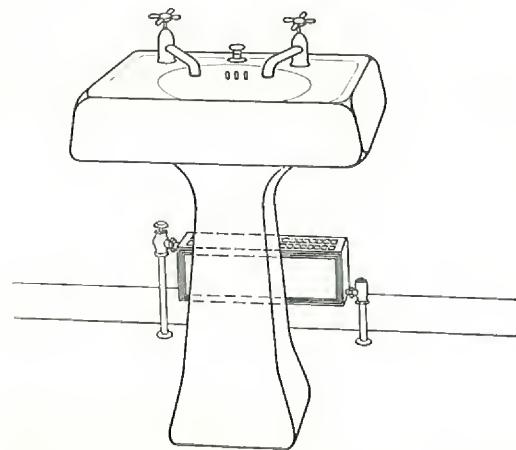
MURRAY PATENTS

Murray Bath Room Radiators



RADIATOR					COVER			
NUMBER OF SECTIONS	SQUARE FEET	F	H	L	SIZE TAPPINGS	W	H	L
6	3.5	1"	8"	13 $\frac{3}{4}$ "	1/2" x 1/2"	2 $\frac{1}{4}$ "	8 $\frac{1}{4}$ "	14"
8	5.	1"	8"	18 $\frac{1}{8}$ "	1/2" x 1/2"	2 $\frac{1}{4}$ "	8 $\frac{1}{4}$ "	18 $\frac{7}{8}$ "

SUPPLY & RETURN CONNECTIONS TAPPED 1/2" STD. PIPE TAP.
 THESE RADIATORS HAVE OPPOSITE END CONNECTIONS.
 RADIATORS SUPPLIED WITH 2" LEGS.
 RADIATORS MAY BE HUNG ON PIPE CONN. IF DESIRED.
 FOR LARGER SIZES USE STD. RADIATORS.



MURRAY RADIATOR CORPORATION

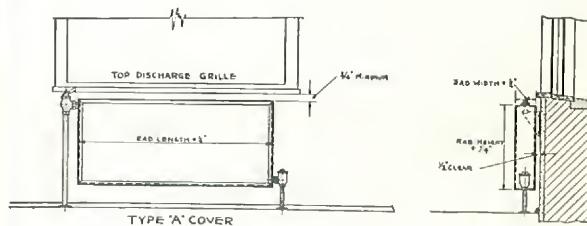
MURRAY PATENTS



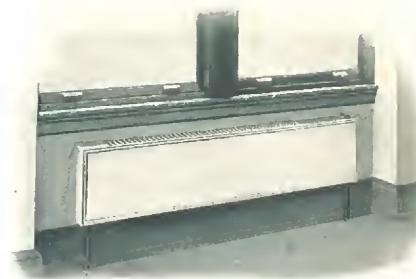
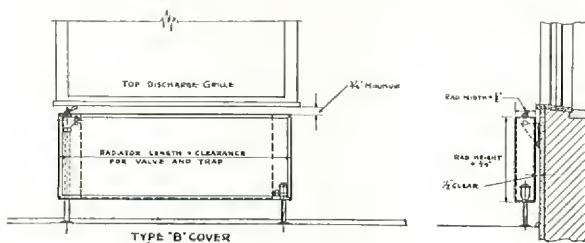
PAGE THIRTY-NINE

Murray Radiator Covers for Exposed Radiators

Roughing in Dimensions



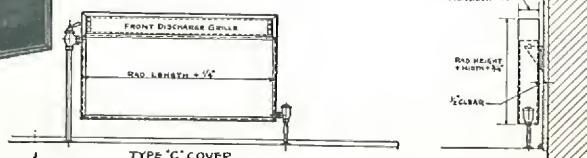
Installation of MURRAY RADIATORS
equipped with TYPE "A" COVERS



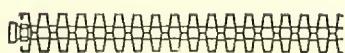
TYPE "B" COVER installation



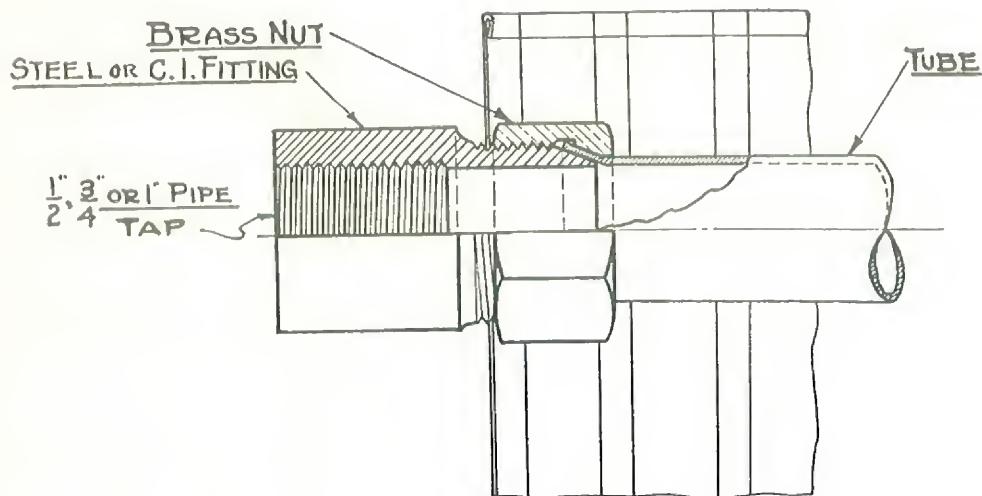
TYPE "C" COVER



"C" Cover should always be used on Blank walls.



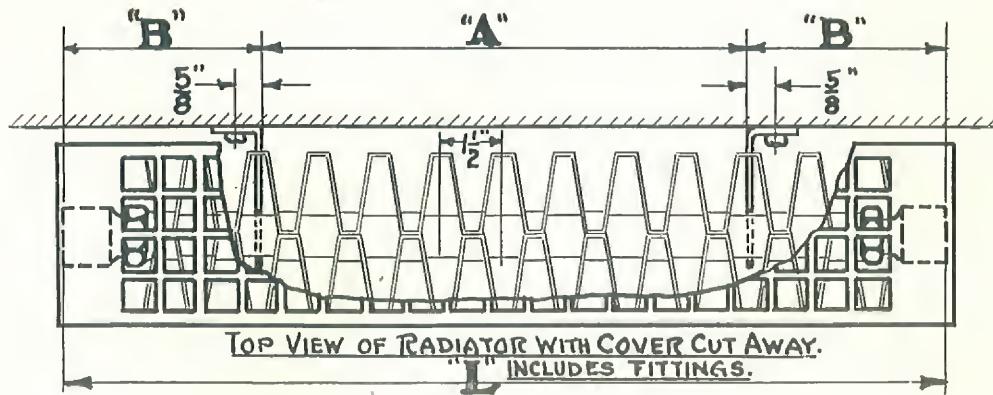
Detail Showing Supply and Return Connections on Murray Radiators



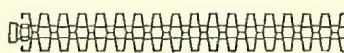
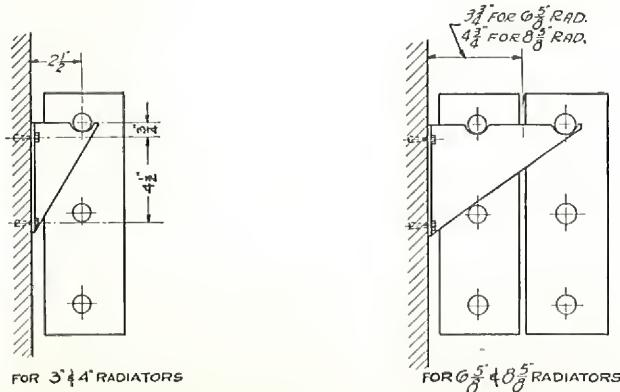
RECOMMENDED VALVE SIZES

Up to 50 square feet	$\frac{1}{2}$ " valve
50 to 180 square feet	$\frac{3}{4}$ " valve

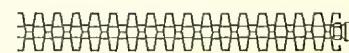
Murray Standard Hangers



Number of Sections	For 3" and 4" Radiators		All Rads.		For 6 5/8" and 8 5/8" Radiators		Number of Sections		For 3" and 4" Radiators		All Rads.		For 6 5/8" and 8 5/8" Radiators		Number of Sections		For 3" and 4" Radiators		All Rads.		For 6 5/8" and 8 5/8" Radiators								
8	L	B	A	L	B		L	B	A	L	B		L	B	A	L	B	A	L	B		L	B						
10	14 1/2	3 1/2	7 1/2	15 1/2	4	26	41 1/2	9 1/2	22 1/2	42 1/2	10	44	68 1/2	14	40 1/2	69 1/2	14 1/2	40 1/2	72 1/2	16	46	71 1/2	15 1/2	40 1/2	72 1/2	16			
12	17 1/2	5	7 1/2	18 1/2	5 1/2	28	44 1/2	9 1/2	25 1/2	45 1/2	10	46	74 1/2	15 1/2	43 1/2	75 1/2	16	48	74 1/2	15 1/2	43 1/2	75 1/2	16	50	77 1/2	15 1/2	46 1/2	78 1/2	16
14	20 1/2	5	10 1/2	21 1/2	5 1/2	30	47 1/2	9 1/2	28 1/2	48 1/2	10	52	80 1/2	17	46 1/2	81 1/2	17 1/2	52	80 1/2	17	46 1/2	81 1/2	17 1/2	54	83 1/2	17	49 1/2	84 1/2	17 1/2
16	23 1/2	5	13 1/2	24 1/2	5 1/2	32	50 1/2	11	28 1/2	51 1/2	11 1/2	56	86 1/2	18 1/2	49 1/2	87 1/2	19	56	86 1/2	18 1/2	49 1/2	87 1/2	19	58	89 1/2	18 1/2	52 1/2	90 1/2	19
18	26 1/2	6 1/2	13 1/2	27 1/2	7	34	53 1/2	11	31 1/2	54 1/2	11 1/2	58	92 1/2	18 1/2	52 1/2	93 1/2	19	60	92 1/2	18 1/2	55 1/2	93 1/2	19						
20	29 1/2	6 1/2	16 1/2	30 1/2	7	36	56 1/2	12 1/2	31 1/2	57 1/2	13	64	98 1/2	19 1/2	58 1/2	99 1/2	20	66	98 1/2	19 1/2	59 1/2	99 1/2	20						
22	32 1/2	6 1/2	19 1/2	33 1/2	7	38	59 1/2	12 1/2	34 1/2	60 1/2	13	70	104 1/2	21 1/2	60 1/2	105 1/2	21	72	104 1/2	21 1/2	60 1/2	105 1/2	21						
24	35 1/2	8	19 1/2	36 1/2	8 1/2	40	62 1/2	12 1/2	37 1/2	63 1/2	13	76	110 1/2	23 1/2	62 1/2	111 1/2	23	78	110 1/2	23 1/2	62 1/2	111 1/2	23						



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